

## **Joint contributions of mathematics teacher educators and indigenous Terena teachers to revitalization of the native language**

### **Contribuciones conjuntas de los formadores de profesores de Matemáticas y los profesores indígenas de Terena para la revitalización de la lengua materna**

### **Contribuições conjuntas dos formadores de professores de Matemáticas e os professores indígenas de Terena para la revitalização da língua materna**

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This study may be understood as a set of ideas, experiences, and proposals about possible directions for indigenous teacher education when the purpose is revitalization of indigenous language in general and the use and valuation of indigenous language in mathematics education in particular. Taking as a point of departure the visions and needs of indigenous Terena teachers relative to native language fluency, we worked with them in one Terena village and produced effective materials for learning language and mathematics (mental calculation, measurements, spatial orientation). Our work focused on the involvement of native-language-speaking elders in early childhood education, especially indigenous language classes, bilingual schooling, and immersion in communal cultural practices.

**Keywords:** Language revitalization, Terena people, Mathematics education.

*To understand the terms revitalization and revival as well as to be able to chose the appropriate set of instruments to implement such initiatives, one must carefully assess the current state of these languages. A language that has no native speakers is called dead or extinct. A language that has no native speakers in the youngest generation is called moribund. A language that has very few native speakers is called endangered or imperiled.*

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Este trabajo trae un conjunto de ideas, experiencias y propuestas sobre las posibles directivas a ser tomadas en la formación de maestros indígenas con el propósito de revitalizar las lenguas indígenas en general, y el uso de estas lenguas en la enseñanza de matemática en particular. El proyecto fue desarrollado en una comunidad Terena tomando como punto de partida la visión de los maestros Terena a respecto de sus necesidades, deseos y condiciones sobre el uso fluente de la lengua nativa. Junto a estos maestros fueron elaborados materiales para el aprendizaje de lengua y matemática (cálculos mentales, medidas, orientación espacial). El área de concentración fue la influencia del uso del lenguaje nativo por parte de los miembros mayores de la comunidad en la educación infantil, en especial, las clases de lengua nativa, la educación bilingüe, y actividades de inmersión de los alumnos en prácticas culturales de la comunidad.

**Descriptor:** Revitalización de la lengua, Terena, Educación matemática.

Este trabalho traz um conjunto de ideias, experiências e propostas sobre as possíveis diretrizes a serem tomadas na formação de professores indígenas com o propósito de revitalizar as línguas indígenas em geral e o uso destas línguas no ensino de matemática em particular. O projeto foi desenvolvido em uma comunidade Terena tomando como ponto de partida a visão de professores Terena a respeito de suas necessidades, desejos e condições sobre o uso fluente da língua nativa. Junto a estes professores foram elaborados materiais para a aprendizagem de língua e matemática (cálculos mentais, medidas, orientação espacial). A área de concentração foi a influência do uso da linguagem nativa por parte dos idosos da comunidade na educação infantil, em especial, as aulas de língua nativa, a educação bilíngue, e atividades de imersão dos alunos em práticas culturais da comunidade.

**Palavras-chave:** Revitalização da língua, Terena, Educação matemática.

## Introduction

In the last ten years, a number of research studies (e.g. Johns & Mazurkewich, 2001; McIvor, 2006; Smith & Peck, 2004; Stikeman, 2001; Suina, 2004) have been published about the cultural movement of indigenous peoples all over the world toward the revival of their native tongues as well as the means, methods, and working styles of this revitalization. Researchers argue that since the mid-twentieth century, indigenous peoples have begun to reclaim their languages and work toward their revival and use, debate some aspects of the endeavor, and discuss possible ways to revive and give a sense of continuity to indigenous languages generally.

As part of our recent effort to better understand the potential to revitalize the Terena language in two different Terena villages, in particular the intricacies and complexities of the mind-frames of indigenous speakers, we worked with Terena to better understand their own comprehension of the revival and continuation of indigenous languages as well as this particular objective. We addressed learning materials in language learning, including research (i.e., indigenous teachers concerned with recovering and maintaining indigenous languages; attitudes of young people toward indigenous language), language classes, other subject classes (especially mathematics), bilingual schooling, immersion practices, and early- childhood focus. We found that many questions and concerns require further investigation.

This research was grounded in the knowledge that our group acquired in the Intercultural Undergraduate Indigenous Teacher Course (FEUSP, 2005–2008), which

included several extended visits to groups of different indigenous ethnicities. From that field experience we began to develop a draft of what could be called an amalgamation between the principle of an indigenous peoples' bilingual education program and an initiative to investigate related issues at a deeper, more academic level. This topic included overall mathematical perception and thought as well the strengthening of indigenous language fluency among indigenous teachers, all within government-generated educational guidelines.

Our research can be justified by the Terenas' own perception, which was shared by the non-indigenous language teachers of the Intercultural Undergraduate Indigenous Course, that Terena language in São Paulo villages is seriously endangered because it is no longer being transmitted to new generations. Surely the objective of maintaining Terena indigenous language (or any other indigenous language) is especially important for maintaining a culture. As for why it is important to maintain native language and culture at all, D'Ambrosio has eloquently addressed this point:

*We are interested that a tree flourishes, then we would be taking good care of its branches, but it will never be strong if its roots are not good, deep... It is useless to try straightening the things of a society if you don't give to the elements that will work in that cultural root, which will grant them strength. If you don't give it, they may be easily manipulated... You can only enter this reflection if you have deep roots and think: "I know myself and know that I am as much a human being as that other one. I know that my culture has as many accomplishments as the other's culture." (Apud Carvalho 2007:264)*

## 1. Background

During 2002 and 2003, in a partnership between the College of Education of the University of São Paulo-USP and the Secretary of Education of São Paulo, Professor Maria do Carmo Domite coordinated the Indigenous Teacher Education Course for the Elementary Level. The basic goal of this course was to generate a proposal for learning/teaching for the elementary schools of the indigenous villages in the State of São Paulo, but to do so in such a way that the indigenous teachers could eventually take over the village schools. Domite was also responsible for constructing lessons in mathematics, as part of the proposed curriculum for the Indigenous Education Program. Sixty-one indigenous teachers from five different ethnic groups (Guarani, Tupi-Guarani, Kaingang, Terena, & Krenak) living in 21 different villages located in different regions of the state of São Paulo took part in this project.

From 2005 to 2009, Domite coordinated the Intercultural Undergraduate Indigenous Teacher Course for Elementary and Middle Schools at the College of Education of the University of São Paulo; those same 61 indigenous teachers participated, as well as 20 more. This time, the author Robert Pohl co-planned the lessons aimed at the revival and use of the Krenak, Kaingang, & Terena native languages, as part of the bilingual perspective of the Indigenous Education Program.

The status of fluency differed for each of the Guarani, Tupi, Terena, Krenak, and Kaingang languages—spoken in the respective villages in São Paulo—was different. The Guarani, in general, and the Guarani teachers in particular are fluent; usually the children do not speak Portuguese before the age of 6. The Tupi are not as fluent, but are aware of this situation and strive for enough creativity to maintain and revive their language. Among the Terena, Krenak, and Kaingang, few adults are native speakers and there are almost none in the youngest generation. As they studied the preservation of

their indigenous languages, the Krenak, Kaingang, and Terena teachers began to systematically approach the revival and use of these languages. Step by step, the two linguists who were teaching them improved their methods, for example by inviting fluent speakers to teach each group.

The general aim of the indigenous undergraduate course was to provide college-level instruction to the indigenous teachers of the State of São Paulo in terms of:

- Strengthening the indigenous school as a culturally situated space.
- Transforming the indigenous school into an intercultural and bilingual center.
- Granting a full-language status to the indigenous language in order to contribute to the development of positive linguistic attitudes among native-language speakers.

In terms of native-language communication and mathematics, the course was based on observation and understanding of indigenous ways of interpreting and enacting linguistic/mathematical relationships. Synthesizing the theorizations of literacy (Freire, 1984, 1994), matheracy (D'Ambrosio, 1999; Skovsmose, 2001) and ethnomathematics (Barton & Alanguí, 2004; D'Ambrosio, 2001; Domite, 2006) we aimed at approaching indigenous children's mathematical mind-frame by contextualizing these concepts within their native educational environments.

Specifically, we defined literacy as the indigenous people's capability of processing information (which included written and spoken language as well as signs and gestures), whereas we defined matheracy as the capability of dealing with codes and numbers, inferring, proposing hypotheses, drawing conclusions from data, and orienting in space. Ethnomathematics focuses on how quantitative and spatial relationships are identified by culturally differentiated groups, according to their own rationalities and in their own terminologies. In terms of mathematics education, similarly to anthropologically-based approaches, ethnomathematics studies the cultural roots of mathematical ideas and attempts to identify mathematical problems in terms of the knowledge of the culturally differentiated Other.

The use of indigenous language and approaches to mathematics within all of these processes is a valuable step toward further intellectual development. The theoretical basis we propose for the learning and teaching process in this indigenous education program comprises the understanding that different mathematical relationships and practices can be generated, organized, and transmitted informally to solve immediate needs, as occurs with language. This way mathematics is incorporated into the core of the learning-by-doing processes of the community and thus mathematics is part of what we call culture. From this standpoint, ethnomathematics is concerned not only with the cultural roots of mathematical knowledge, but also quantitative and spatial relationships generated within the cultural community, which often compose mathematics as well (D'Ambrosio and Domite 2007:201).

## **2. Research Questions**

With a focus on these views of indigenous education, this study aimed to provide evidence for the following research question: In terms of our personal and professional experiences as mathematics educators with indigenous Terena teachers, which

directives and possible interventions might be used to construct a contextualized proposal for indigenous language revitalization? Two other possible questions involve which directives and interventions might be used to reinforce the use and valuation of indigenous language, and how, as mathematics teacher educators as well as indigenous teacher educators, we can advantageously use mathematics activities for the indigenous language revitalization process.

### 3. Method

The aim of this qualitative study was to investigate the use of certain activities in revitalizing native-language use among indigenous Terena teachers and, in turn, among their pupils. Meetings and discussions about the contents presented to the indigenous teachers provided the qualitative data; the quantitative results within this data were used to understand the emotional and intellectual preoccupations of the participants, generate questions, and provide context for the qualitative analysis.

We gathered information about how these indigenous teachers became more and more enthusiastic and made progress in using their native languages in a sort of action research process. First, both the indigenous Terena teachers and the non-indigenous teacher educators actively agreed to work on this revitalization process. Second, the act of finding evidence helped us to understand our process as researchers, not only in terms of what we proposed to do to solve these problems, but also in terms of the factors that affected what we were doing. We understood throughout that, in practice, the aim of an action researcher is to bring about development by analyzing existing practices and identifying elements for change. In our work, we combined two types of action research: indigenous teachers reflected on their practices, and non-indigenous teacher educators investigated their support processes. This study was conducted in one indigenous Terena indigenous village (Ekeruá, Bauru/SP) during the first semester of 2010. Three different encounters took place on three consecutive days and lasted for a total of six hours each day.

In order to understand how the professional development of Terena indigenous teachers can be best supported by educators from outside that culture, we felt that we must acknowledge certain conceptual problems pertaining to psycho-epistemological issues. For example, we as non-indigenous teacher educators seemed to know that we were expected to listen to and understand the problems of the indigenous teachers in light of the education of their own people and that we knew to listen to what the indigenous teachers had to say as well as what they felt, expected, and thought, all while respecting the cultural and social differences between us (Domite, 2010:308).

#### ***3.1. Toward the Indigenous Village: Terena Language in Action***

The experiences we describe here took place, as previously mentioned, in the Terena village of Ekeruá during three different working meetings that lasted six hours each. After our arrival at the village, we spent some time with the chieftain as he demonstrated a broad view of linguistic revival. After speaking with him for a half hour, we asked him for permission to gather as many indigenous teachers as possible. Next, in collaboration with our indigenous colleagues and the chieftain, who was very receptive, we gathered in a classroom and concocted a work plan for the three days of our stay.

Having arrived with a set of suggestions, we shared these thoughts and considered them, as a group, in terms of the perspective of the local teachers.

Our informal discussion with the eight Terena teachers and their chieftain included telling them that one of the aims of this revitalization movement for their language was to expand their education as indigenous teachers so that they could work in a bilingual context. In other words, we informed them that we would be orienting them in ways that would guarantee their use of both indigenous and Portuguese language with their pupils. Then, jointly, we tried to reach an understanding of what it means to work in a bilingual context (e.g., alphabetizing the children in native and Portuguese language, stimulating bilingual fluency, and so forth). At this point, some differences and contradictions appeared. For example, some of the indigenous teachers wanted to emphasize indigenous-language conversation, whereas others preferred to teach reading and still others thought that the progression of listen-speak-read-write was most important.

The atmosphere on this first day was relaxed and informal, possibly because of our conscious creation of a social and affective approach as we tried to understand what the teachers were already doing to promote the revitalization of their own language. During the second encounter the teachers displayed a more involved and participatory attitude, perhaps because of the nature of the activities we proposed. They also arrived at this second gathering with a different degree of involvement, such as deciding to take a deeper and keener look at the actual requirements for the success of the linguistic revival project. The third day was invested with the importance of sharing experiences of the implementation of the proposed tasks as well as initial, general findings.

### ***3.2. Investigative dynamics***

The activities we proposed in order to construct evidence that could be used for subsequent analysis were based on at least two cognitive pedagogic principles. The first was our concern with the development of positive attitudes on the part of the indigenous teachers and with paying attention to their predisposition to solve problems inherent to bilingual communication. The second was our conviction that the construction of knowledge, which is the result of mental activity on the part of the learner, is based on student-teacher relationships as well as self-elaboration in dialogical processes with an “other” during which the subjects assume a larger conceptual understanding.

The analytical perspective of the empirical activities we proposed and discussed with the indigenous teachers is theoretically supported in works concerning Freire’s viewpoint. In other words, we found data and evidence in the other’s answers and did not arrive with a fixed or prejudiced set of ideas about the other.

### ***3.3. Investigative Activities***

#### ***3.3.1. Arguments and empirical elements of the results***

The indicators that made it possible to understand the variables related to our goals were obtained with two instruments: the investigative activities themselves, and dialogue with the Terena teachers. The latter was focused upon their feelings about and predisposition to the revitalization of their own language, either by means of scholarship (mathematics education) or by social/political/linguistic empowerment. The following activities were carried out.

### 3.3.2. *Walking in several directions according to instructions*

In order to engage indigenous teachers in the process of reflecting upon their teaching and learning of geometry (i.e., of geometric relationships) we encouraged them to talk about representations they perceived via the observation and representation of movements and constructions in terms of their living spaces. The proposed activities were intended to lead students to coordinate visual information taken from the world around them, including their perceptions of the body in action (displacements, constructions) and spontaneous speech about their representations.

In the first step, we asked one volunteer indigenous teacher to tell another teacher, using body language only, to stand up, sit down, and look at the window. These instructions proved to be relatively simple to communicate.

In the second step, the second indigenous teacher was asked to tell the first one verbally, in Terena language, to take two steps forward. This volunteer looked to his colleagues, who were sitting nearby, for oral guidance.

In the third step, we instructed the first teacher, in Portuguese, to tell the second teacher to turn left or right. He did not know what to say. When there was a murmur and an exchange of looks among others who were present, he directed his eyes to a nearby window located to his left. After seeing this prompt, the other teacher walked in that direction. During the discussion, a female teacher who was more fluent in Terena than most of her colleagues explained that in Terena there is no expression for “the left side.” After the process was repeated with an instruction to move to the right, for which there is also no expression in Terena, the participants realized that the Terena language also has no single words that mean “left” or “right.” Instead, native speakers of Terena use body language to indicate physical markers and boundaries that they use to spatially orient themselves.

Next, an indigenous teacher was given a sheet of paper with a rectangle drawn on it and was asked not to show this geometric shape to his colleagues. This teacher was then asked to orient another indigenous teacher, in their Terena language, to physically construct the geometric figure by walking around the room. Other figures were communicated in a similar fashion.

### 3.3.3. *Similarities and differences*

In this hypothetical exercise, a student would throw a ball to another student while saying loudly, in Terena language, one similarity between them (e.g., “white T-shirt”). Then the student who had caught the ball would throw it to another student while loudly observing one similarity between them (e.g., “brown hair”). And so on.

### 3.3.4. *Mental calculations*

The teachers were invited to choose, with total freedom, strategies for mental computations (addition, subtraction, multiplication, and division) in ways that would accomplish at least two goals: students’ acquisition of a more autonomous relationship with their mathematics thought and student understanding of arithmetical calculations not just as an exercise in mathematical thought but also in terms of social, political, or economic situations in daily life (Domite, 1996; Skovsmose, 2001). With the sample equation of  $28 + 16$ , we noticed (after a not-so-easy time) that the teachers were loudly

reciting the following three calculations, using some words in Terena language but most in Portuguese:

$$28 + 16: 28 + 10 = 38, 38 + 6 = 44 \quad (1)$$

$$28 + 16: 20 + 10 = 30, 8 + 6 = 14 = 10 + 4, 30 + 10 + 4 = 44 \quad (2)$$

$$28 + 16: 30 + 16 - 2 = 44 \quad (3)$$

They seemed to be working from a mental image of the conventional pen- and-paper algorithm known as “carrying one.”

### *3.3.5. Vocabulary practice*

In this exercise, students would be prompted by an indigenous teacher to research names of birds, plants, trees, geographic features, and so forth, in order to bring out their natural curiosity and, by so doing, to develop vocabulary and linguistic skills in their native tongue.

### *3.3.6. Immersion practices*

Based on the indigenous teachers’ report that they were already used to meeting with students on Saturdays to play guitar and sing as well as to rehearse theatrical productions, we proposed the concept of a “Language Saturday” during which all members of the village would be motivated to practice in their native language.

### *3.3.7. Bilingual schooling*

From our knowledge of other researchers who have experienced similar dilemmas about the revitalization of indigenous tongues, we concluded that one valid suggestion to stimulate and enhance the usage of native ways of communicating among indigenous students is to split language use between the two periods in which they attend school Bello (2000), Reyhner (1990). For example, in the mornings the children/teenagers would be taught in Portuguese and in the afternoons they would be exposed to their native tongues.

### *3.3.8. Focus on the children*

From our observation that many adults and/or elders were Terena-language-fluent speakers, we led the indigenous teachers group to consider that the frequent presence of village elders in the children’s classrooms would be of the utmost importance for cultural crossover. Through storytelling, for example, elders would be invited to share their life experiences, their perceptions of the ways of the past, and their language database.

### *3.3.9. Indigenous teachers as researchers*

The native teachers were invited to raise awareness by producing research that would elucidate why their language, in their community and in their vicinity, suffers degradation and is even in danger of extinction. These studies and their results should be made available to the all other Terena villages from São Paulo, where they would be thoroughly discussed.

In summary, at the end of the three days, we decided -together with these indigenous teachers- to produce effective didactic materials for learning indigenous language and mathematics (mental calculation, measurements, spatial orientation, etc.) that would focus on five different actions: a) involvement of native-language-speaking elders in



early childhood and elementary education; b) dedicated indigenous-language classes; c) bilingual schooling; d) immersion activities in communal cultural practices; and e) research by indigenous people of the reasons that so few people are speaking the native language.

## **4. Findings**

The issues of language revitalization that arose in this indigenous teacher education context led us to focus our attention on three categories of analysis emerging from this study:

- ✓ Requirements that would enable Terena indigenous teachers to be able to conveniently enact tasks related to the usage of their native language, and successful ways of doing so;
- ✓ The strenuous manner in which Terena people negotiate their relationship with the bilingual perspective of the Intercultural and Bilingual Indigenous Education Program; and
- ✓ Differences of receptivity and expectancy in terms of mathematics activities intended to improve Terena language fluency.

It is our finding, based on the different pedagogical actions and manifestations on the part of the indigenous teachers, that when given the appropriate guidance and instruments, the parties involved experience an awakening in terms of language fluency. It seems to us that the indigenous teachers, their students, the students' parents, as well as village or community elders and, in this case, the chieftain, were thinking about the possibility of classes being taught prioritarily in their tongue. It also seems clear to us that all of the teachers, as well as the chieftain, accept the task of disseminating the ways of yesterday and are committed to improving the speaking of their native tongue.

We also conclude that the reversal of the imperilment of an indigenous language should not only prove to be highly feasible by teaching indigenous students, but also should prove quite effective in associating the idiosyncrasies of this manner of linguistic revival, by means of all the specific techniques that could be involved, with the particularities of the construction of knowledge of basic mathematics. More expressive forms of enthusiasm and receptivity were noted in the activities that involved mental calculation, in that the self-capacity -autonomy- of calculating by one's own means seems to be understood as a possibility of significative learning.

One aspect that provided a way to diminish the level of degradation of the Terena language was the attempt to recover the interest of the youth by increasing their passion and natural curiosity about the ways of the elders by resuming the regular evening practice of sunset gatherings at the House of Prayer. This practice is a powerful tool that, unfortunately, has been sidelined and even forgotten due to the competition provided by, for example, soap operas on TV.

In terms of what would be required for teachers to perform this reversal, the elders would have to be fully available to answer students' inquiries about the old ways, legends, tales, folklore, and general ancient knowledge. Such interactions would be mostly put into practice in the original native tongue, as a means to generate curiosity among the youngsters.

We found that this initiative - three days of meetings - did generate some discrepancies. A certain perceived difference of expectations seems to have been located in the teachers' own perceptions of improving fluency, such as the extent of the lack of fluency and/or the value given of revitalizing the mother tongue.

## **5. Conclusions**

At the core of our research rested the conviction that it should be not merely possible, but is in fact quite necessary, for the native groups we advised throughout our study to develop their traditional linguistic proficiencies to a functional stage. This conviction is in accordance with the official directives provided by the educational indigenous movement in Brazil. Gradually, we noticed, on the one hand -perhaps due to our own natural curiosity and predispositions to learning the old ways- quite substantial and enthusiastic participation by the indigenous teachers in the proposed activities. On the other hand, it has become more and more clear to us in the course of this research that this initiative not only strengthens the intergenerational bonds but also instills a sense of ancestry in the older generations and a sense of belonging in the younger ones.

We came to realize, with a great sense of self-esteem and joy shared by our indigenous colleagues, that the more we all persevered in the proposals, discussions, exercises, and practices aimed at raising awareness of linguistic revitalization, the more names of the past emerged. In fact, manners of ancient expression and calculation seemed to pop up in conversations as an overall sense of traditionalism became more evident.

It is important to emphasize our recognition, as teacher educators foreign to this indigenous culture, the constant need to question the role and the meaning of the dominant language (Portuguese) and its consequences, which include recognizing that the Brazilian Federal government sometimes aims for assimilation and, at other times, recognizes its obligation to support Indian language preservation. Indeed, the indigenous policies in Brazil (as well as worldwide) have always been a national project inside a larger one that has not taken plurality into consideration because it has contained the unspoken goal of unifying (i.e., erasing) cultural differences. Unification, whether or not it manifests as erasure, does not attribute value to linguistic diversity and indigenous knowledge.

Finally, from the perspective of mathematics education as well as from our perspective as indigenous teacher educators, we were unsure about how we could apply mathematics activities in order to transform the indigenous language revitalization process. In other words, the value of orienting teachers to motivate fluency in Terena language among their students, whether the activities involved concerned mathematics, arts, or other fields of knowledge, remained unclear -as did the actual roles to be played by these teachers. It seemed to us that the focus of teacher education in terms of the revitalization of the Terena language must be upon problematizing the processes by which the cultural knowledge of the teacher educators as well as of the indigenous teachers themselves becomes the heart of instruction.

The factor that gained the most clarity was the transformation of the way of being, as a learner, a member of the Terena people during this teacher education process. We perceived this growing clarity as the indigenous teachers posed questions and as we, as teacher educators, questioned them. The questions of the Terena indigenous teachers

about their fluency in their own language became significative solider. In fact, they began to problematize their own ways of thinking about these linguistic cultural dynamics during the course of our meetings

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